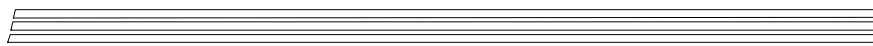




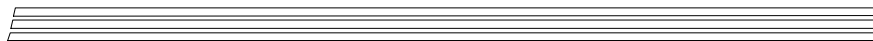
***Port of Houston Authority
Air Quality
How to Get There***

Wade Battles
Managing Director



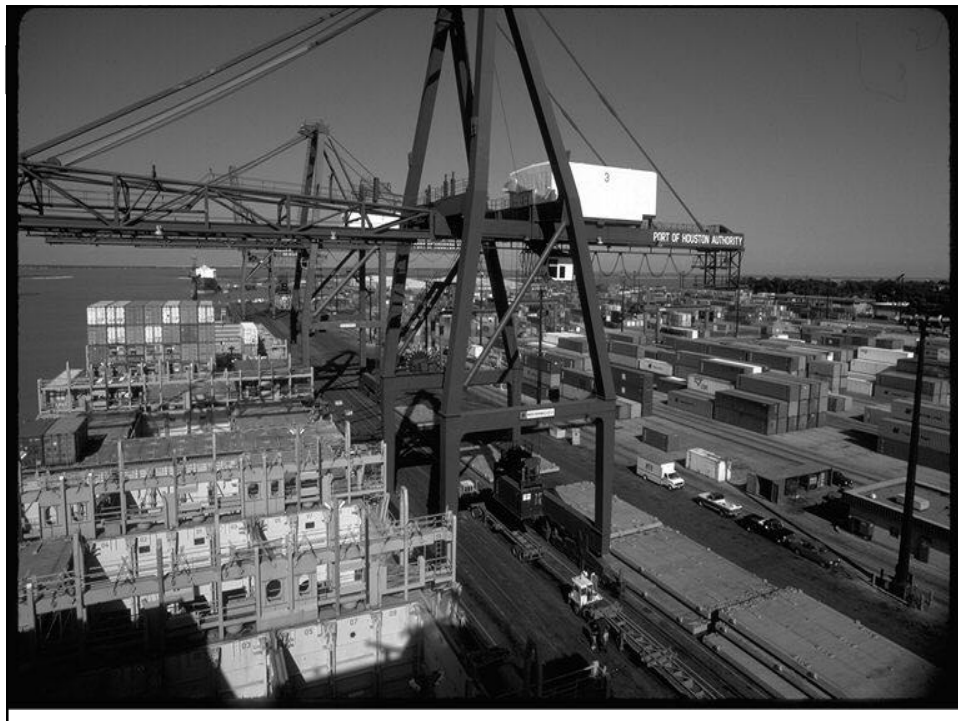
How to Get There!

- Port of Houston Authority
- The Beginning...
- Demonstration Project
- The Future...
- Lessons Learned



Port of Houston Authority (PHA)

- PHA owns Eight Public Terminals Along the Ship Channel
 - Both an Operating and Landlord Port
 - Owns and Operates Hundreds of Pieces of Equipment
 - Has Large Construction Projects
 - Middle of a Major Dredging Project
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The Beginning...

- Changing Proposed SIP Requirements
 - Continuous Statement “The Ports in California are doing it...”
 - The PHA’s desire to be a leader in Environmental Issues
 - The TNRCC’s Taking of Voluntary Measures
 - Many of Port Actions could have National/International Implications
 - Port willing to do Demonstration Projects with its Equipment
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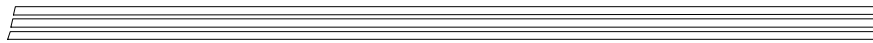
Demonstration Project

- Mandatory Requirements for Successful Demonstration Program
 - Complete Buy In from all PHA Departments Especially Operations
 - Formation of Internal Team including Purchasing and Operations
 - Emissions Inventory for the Fleet
 - Set Requirements and Objectives
 - Thorough Research on Technologies
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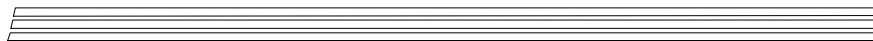


Requirements and Objectives

- Safety!
- Not Voiding Manufacturer's Warranty
- Evaluate Fuel Requirements--Fueling Locations, Fuel Availability, Fuel Stability
- Is Space Available on the Equipment for a Retrofit?
- Flexibility on Operational Capability
- Finding the Greatest Return on Investment
- Where can you get Funding and What for?
- What is Available in your Time Frame?
- How will Credits be Received for Reductions



Results of the PHA Air Quality Demonstration Projects



PHA Emissions Inventory

- 100 Onroad Fleet Vehicles
- 800 Offroad Vehicles
 - 258 Yard Tractors
 - 26 RTG's
- 1999—6 tons per day for Offroad Terminal Equipment



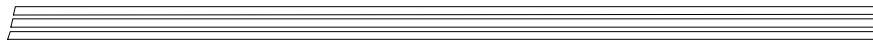


Onroad Solution...Propane Trucks and Hybrid Electric Cars

- Purchased one “demo” propane truck.
- Set up Account For Fueling close to the PHA
- Received Grant to Install Two Fueling Stations in 2001
- Currently Purchasing 20 propane trucks
- Replacement of Fleet Cars with Hybrid's in 2002

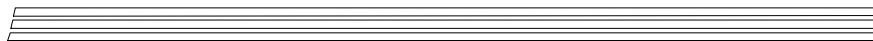
Offroad Issues...

- Safety Issues with Lifting Equipment
- Some Equipment can Travel to the Fuel; Others Cannot
- Equipment Should Operate 24 hours Before Refueling
- Some Space Available for Fueling Stations
- Non Availability for Equipment Downtime
- Time—Need the Technology NOW
- Costs—Must Have Funding



First Stab at a Solution

- Lubrizol's PuriNOx
- Propane
- Selective Catalytic Reducer (SCR)

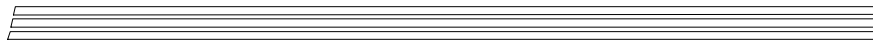


Lubrizol's PuriNOx

- Research Revealed...
 - Estimated 25% reduction in NOx and 30% reduction in PM
 - Ease in Converting Fleet

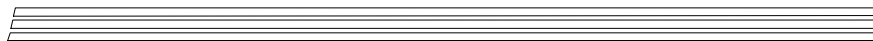
But

- Potential for Loss in Horsepower



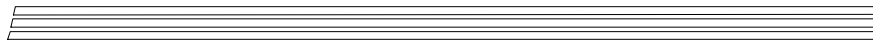
Lubrizol's PuriNOx

- Results...
 - Verified NOX and PM reductions with **No Horsepower Loss**
 - First fueling and Emissions Testing in March 2000...2 yard tractors
 - January 2001-Five yard tractors and 2 RTGs
 - Tested in Tour Vessel with Great Success
 - June 2001 - Ten additional units added



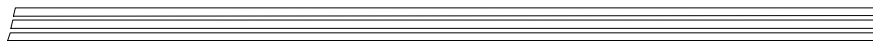
Propane

- Great for onroad vehicles & small forklifts
- Two propane fueled yard tractors delivered to Port of Los Angeles
- Cannot Retrofit RTGs....Limited Space for Fuel and Engine
- Need to Design for RTGs, Top Lifts , & Large Forklifts



SCR

- One SCR Ordered and Delivered for RTG
- Numerous Contract Issues and Installation Problems with Vendor
- Second SCR Ordered for Additional RTG
- Vendor Attempted to Change Contract after Purchase Order was Issued



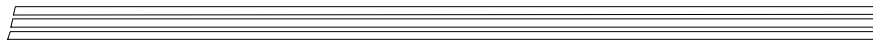
The Future...

- Keep TNRCC from Taking our New Ideas
 - Fuel Cell Container Ship Project... Looking for Sponsors
 - Emission Testing of PuriNOx and SCR on RTGs
 - Emission Testing of PuriNOx in Tour Vessel
 - Continued expansion of PuriNOx Use
 - Meeting with new Vendors Monthly
 - Quality Shipping Program
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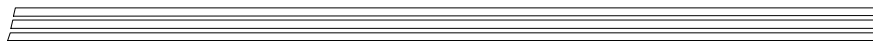
Lessons Learned... ..

- Commit to a Technology After Thorough Research
- Funding..
 - It's out there...but no free lunch
 - Be careful of requirements and restrictions
- Form a True Partnership with Technology Company
 - Discuss Failures and Risks
 - Get Commitments Upfront
 - Identify Problems and Resolve



Lessons Learned...

- Negotiate a Good Contract
 - Installation
 - Warranty
 - Supplies
 - Maintenance
 - What if something goes wrong?
- Get Agency to approve testing upfront
- Educate the Agency
- Involve your Customers





Port of Houston Authority

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